

## Catalogue of American Amphibians and Reptiles.

MARTOF, BERNARD S. 1974. Sirenidae.

## Sirenidae

## Sirens

Sirenidae Gray 1825:215. First use of name.

Sirenidae Cope 1889:223. Content restricted to *Siren* and *Pseudobranchius*.

• CONTENT. Two genera are extant, *Siren* and *Pseudobranchius*. *Habrosaurus* (Gilmore, 1928:161, including *Adelphesiren*, Goin and Auffenberg, 1958:453) is known only from Cretaceous-Paleocene deposits from Wyoming and Montana.

• DEFINITION. Living sirenids are among the most paedomorphic amphibians. These aquatic salamanders have a greatly elongated, eel-like body with 29–40 costal grooves. Adults are 100 to 950 mm in total length. The tail is about 26 to 40 percent of the total length, broadly oval in cross-section near its base and strongly compressed toward the tip with a narrow fin along most of its dorsal surface and about half the ventral surface. The fully metamorphosed skin is smooth and glandular; its secretion is innocuous (Noble, 1931). Pelvic limbs and girdles are absent. The pectoral limbs are reduced and are used in crawling; each has 3 or 4 digits, with small horny tips but no webbing. The three pairs of external gills are retained throughout life. They are long and bushy but shorten under adverse conditions. The posterior pair is usually the longest. The gill rami are fimbriated. In *Siren*, a gill slit is located at the base of each gill; the middle slit is the largest and the anterior one is the smallest. In *Pseudobranchius* only the anterior slit persists. The lungs are highly vascular, septate, and large, extending almost to the cloaca (Czopek, 1962). The eyes are tiny and lack lids and retractor muscles (Hilton, 1956). The mouth is small, crescentic and subterminal; its lining is nonvascular. The margin of each jaw is covered by a horny sheath, the lower jaw may be toothless or have slender, pointed teeth. The tongue is generally small; its anterior half is free. The nostrils are small, slit-like and valvular. Jacobson's organ is large and is provided with a special choanal valve. Pendulous extensions of the atria characterize the heart. The digestive tract is short and only slightly folded. The testes are not segmented and the thyroid is large. The vertebrae are amphicoelous; each has a relatively large neural arch with prominent aliform processes. Only the anterior vertebrae have ribs. The coracoid is a separate ossification, as in anurans. The skull is elongated. The maxilla is present (contrary to Noble, 1931); it is tiny, bears teeth and is unattached to other bones (Parker, 1885; Estes, 1965). The premaxillae lack teeth and their ascending processes are widely separated by the nasals. The palatal teeth on each side consist of two groups, of which the prevomerine group is larger than that of the pterygo-palatine. The dentition is larval (Larsen, 1963), not pedicellate as in most other amphibians (Parsons and Williams, 1963; Means, 1972).

• DIAGNOSIS. By having only the pectoral appendages, sirenids are easily distinguished from other amphibians. They are sometimes confused with *Amphiuma*; however, all *Amphiuma* lack gills, have both pectoral and pelvic limbs, and are more diurnal. Members of the order Gymnophiona also have greatly elongated bodies, small lidless eyes, and no pelvic girdles and limbs, but the following characteristics distinguish them from the sirenids: vertebrae many (more than 200), some species with tiny mesodermal scales embedded in skin, a small protrusible tentacle between eye and nostril, left lung reduced and right lung very long, pectoral limbs absent, and males with a protrusible copulatory organ. See FOSSIL RECORD.

• DESCRIPTIONS AND DISTRIBUTION. See generic accounts.

• ILLUSTRATIONS. See generic and specific accounts of *Siren* and *Pseudobranchius*. Skeletal elements of *Habrosaurus* are illustrated by Estes (1964, 1965).

• FOSSIL RECORD. Sirenids have a long record extending back to the late Cretaceous. *Habrosaurus* (Gilmore, 1928:161, including *Adelphesiren* Goin and Auffenberg, 1958:453) is known from Upper Cretaceous-Paleocene deposits from Niobrara County, Wyoming, and from McCone County, Montana (Estes et al., 1969). This large sirenid has a relatively short

skull, not elongated as in *Siren* (Estes, 1965). The snout is blunt, as in most other salamanders, and is provided with crushing dentition. Also, the aliform processes of the vertebrae are less developed than in *Siren*. See generic accounts of *Siren* and *Pseudobranchius*. The genus *Prosiren* (Goin and Auffenberg, 1958) from the Lower Cretaceous has been placed in a new family Prosirenidae; it is not related to the sirenids (Estes, 1969). The supposed fossil *Palaeosiren* is not based on organic remains (Estes, 1970).

• PERTINENT LITERATURE. See generic and specific accounts. For information on collecting see Bennett and Taylor, 1968; Fouquette and Delahoussaye, 1966; Gunning and Lewis, 1957; Jobson, 1940; and Scroggin and Davis, 1956.

• ETYMOLOGY. See generic accounts of *Siren* and *Pseudobranchius*. *Habrosaurus* is from the Greek *habros* meaning soft or delicate and *saurus*, lizard.

## • KEY TO GENERA

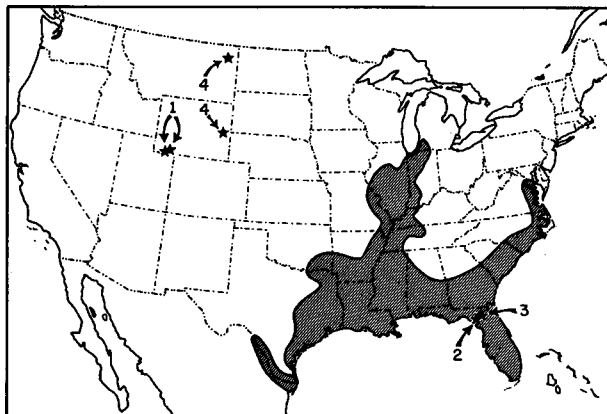
1. Small, adults usually 100 to 150 mm in body length, maximum 250; 3 digits per pectoral limb; 1 pair of gill slits; skin larval; longitudinal light stripes persistent ..... *Pseudobranchius*
- Large, adults longer than 175 mm, maximum 950; 4 digits per pectoral limb; 3 pairs of gill slits; skin fully metamorphosed; longitudinal light stripes on hatchlings and early juveniles only ..... *Siren*

• REMARKS. Sirenids are primarily nocturnal, spending the daylight hours burrowed in or under debris on bottoms of ditches, ponds, and other bodies of shallow water (Viosca, 1937). During droughts they often become entombed in mud (Carr, 1940; Cockrum, 1941; Freeman, 1958), secrete a mucus cocoon (Reno et al., 1972) and survive by using their extensive stores of fat (Martof, 1969).

Sirens have efficient means of respiration. The capillaries of the gills provide 3 percent of the total respiratory surface, the skin 36 percent and the lungs 61 percent (Czopek, 1962; Guimond, 1970). Only about a third of the total surface is ordinarily used, thus there is a large margin of safety, permitting use of otherwise unfavorable habitats (Ultsch, 1971) and survival under adverse conditions.

Sirens lack vocal cords but produce various sounds. *Siren intermedia* emits a series of faint clicks when it enters a strange area or when it leaves a burrow to gulp air at the surface or when another siren approaches (Gehlbach and Walker, 1970). It may also "yelp" when disturbed by another siren. *Siren lacertina* confined by drought to small chambers in dried mud may produce sounds reminiscent of *Hyla cinerea* calling at a distance (Carr, 1940).

Nothing is known of sirenid courtship. Some evidence suggests external fertilization. For example, males lack cloacal glands, females lack spermathecae and both sexes lack cloacal papillae (Dunn, 1923). Noble and Richards (1932) obtained a few fertilized eggs by injecting several adults with gonadotropins but mating was not observed. Sirenid eggs lack pedicels



MAP. The numbered stars indicate fossil localities. 1. *Siren dunni*, Eocene. 2. *S. hesterna*, Lower Miocene. 3. *S. simpsoni*, Pliocene. 4. *Habrosaurus*, Upper Cretaceous to Paleocene. See account of *S. lacertina* for Pleistocene records.

and each is surrounded by 3 capsules; the inner one is very thin and the outer is slightly opaque and very adhesive. The spermatozoa differ from those of other Amphibia; each has 2 undulating membranes (Austin and Baker, 1964). Hatchling sirenids lack balancers.

## COMMENT

Some herpetologists (Cope, 1889; Goin and Goin, 1962; Cochran and Goin, 1970) have placed sirenids in a separate order Trachystomata. After detecting albumin in the blood of *Siren*, Guttman (1965) recommended that modern techniques be used to examine other salamanders. If they lack albumin, he, too, would consider placing the sirenids in a separate order.

The early appearance and abundance of sirenids (and amphiumids) in the fossil record suggest early divergence from the major urodelan stock (Tihen, 1968). Nonetheless, sirenids closely resemble other salamanders in reproduction (Dunn, 1923) and in hyoid, vertebral and cranial morphology, particularly of the palatal elements (Estes, 1965; Wake, 1966). Vertebral differences do not convincingly set the sirenids apart from the salamandrids (Estes, 1965). Extant sirenids resemble salamandrids in many ways: relatively large neural arch, extreme lateral placement of the olfactory lobes of cerebrum (Noble, 1931), and their serological relationships (Boyden and Noble, 1933). Thus ordinal status is not warranted (Larsen, 1963; Estes, 1965). Sirenids, however, do constitute a separate suborder Sirenoidea (Wake, 1966), formerly Meantes (Linnaeus, 1766; Stejneger and Barbour, 1917, 1943).

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